regretted, as there are two well-known works to which the epithet is fairly applicable, and which are at least free from such erroneous facts and false or exploded theories as have been pointed out in Dr. Page's volume.

ALFRED R. WALLACE

OUR BOOK SHELF

Half-hours in the Green Lanes: a Book for a Country Stroll. By J. E. Taylor. (Hardwicke.)

THERE are two ways at least in which the first principles of Natural Science may be taught to the youthful mind, as well as to "intelligent people who have not had time to enter into the technicalities of scientific questions." One which, if we may judge from the number of elementary works on Physics in which it is adopted, has many arguments in its favour, consists in the careful and logical working out in detail of a few of the most important principles of the Science, together with the different steps by which they were arrived at; the knowledge of minutiæ being left for future observation and study, on the foundation supplied: and the other is little more than a compilation of disconnected facts, of unequal importance, arranged with an endeavour to make them impressive from their almost endless number, and strung together with teleological argument. The tenants of the "tarns and green lanes being the objects treated of, there is an expanded field for the 300 or so short pages, in which the fishes, molluscs, and reptiles of the former, as well as the birds, insects, and plants of the latter, are rapidly passed in review. Several excellent figures illustrate the work, Mr. Wood and Mr. Keulemans contributing to the ornithological section; however, we are surprised to see so many on subjects of comparatively little importance, as the 14 on the slight variations in the shape and marking of cycloid scales, and the 32 on the different species of snails. Turning to the letterpress, many of the descriptions will be found to be accurate and clear, and a few sufficiently long to enable the uninitiated to form a fair idea of the subject. Many however are so short and incomplete that but little can be made of them without extraneous assistance, and in some the carelessness in the choice of words adds to the difficulty, as where the Vapourer Moth (*Orgyia antiqua*) is said to derive its name "from the habit of the winged males rising and falling simultaneously in their flight." A fact is sometimes stretched to make a *simile*, as when we are inaccurately told that "the generic name of the Kingfisher (*Halcyon*) is derived from the ancient belief that when it was hatching its eggs, the water was always calm and still." The genus *Turdus* is more than once called *Tardus*, and several other mistakes show that the author's knowledge of the subject is not of the deepest, as when the hind wing of the Clifden Nonpareil (*Catocala fraxini*) is said to be black and red, and the wide geographical distribution of the Kingfisher is given as a reason for supposing that it has a comparatively high geological antiquity. Notwithstanding its faults, however, there are many points in this small work which will make it of more than ordinary interest to the general reader.

The Royal Readers. Nos. 1 to 6. (Nelson and Sons. London and Edinburgh.)

THE excellence of these reading books and their adaptation to the broader culture of the present day demand from us some notice. The editor of the series, who has done his work with unusual ability, tells us in the preface that his aim has been to cultivate the *love* of reading. So far as we are able to judge, this aim he has successfully carried out by presenting interesting subjects in an attractive way. Opening any one of these Readers, we are struck with the air of freshness and interest it possesses. An intelligent child, instead of closing the book with relief, is far more likely to leave it with regret. And added to the happy way in which the lessons have been prepared, the pages abound with capital woodcuts, some of which are of real beauty. There are none of the stereotyped cuts of stale children in old-fashioned dresses and hair in pig-tails, primly grouped at play, and supposed to illustrate the story of the goody-goody girl, or the naughty-naughty boy. Our children are mercifully spared from these haunting ghosts of our childhood and have their Royal Readers instead. But these books have a wider scope than mere reading lessons. In the fifth and sixth books we find a large amount of sound scientific knowledge conveyed in a course of lessons carefully prepared by the editor. Then there are articles on physical geography, the bed of the sea, the various ocean routes, and lessons on useful inventions, besides some other novel features which we have not room to detail. The employment of these reading books will certainly tend to create a love for healthy reading, and at the same time they seem likely to be of the highest service in training and furnishing the minds of children.

LETTERS TO THE EDITOR

[*The Editor does not hold himself responsible for opinions expressed by his correspondents. No notice is taken of anonymous communications.*]

Atoms and Ether

I AM not enough of a metaphysician to say whether a substance which can be compressed and expanded *necessarily* contains void spaces.

If so, the idea of air, furnished to a beginner by instruction in "Boyle's Law," is self-contradictory; and any molecular theory afterwards developed in order to account for "Boyle's Law," may claim not only ingenuity but necessity in order to abate a crying grievance to all right-minded persons.

I do not myself believe in Prof. Challis's æther, but at the same time I do not believe in the power of the human mind to pronounce that a continuous medium capable of being compressed is an impossibility.

But, on the other hand, I am sure that a medium consisting of molecules is essentially viscous; that is, any motions on a large scale which exist in it are always being converted into molecular agitation, otherwise called heat, so that every molecular medium is the seat of the dissipation of energy, and is getting hotter at the expense of the motions which it transmits. Hence no perfect fluid can be molecular. So far as I can see, Prof. Challis intends his æther to be a perfect fluid, and therefore continuous (see p. 16 of his Essay), though he does not himself pronounce upon its intimate constitution.

Hansemann* makes his æther molecular, and in fact a gas with the molecules immensely diminished in size.

With regard to Mr. Mott's iron bar, when he pulls one end he diminishes, in some unknown way, the pressure between the particles of the iron, and allows the pressure of the æther on the other end to produce its effect.

N.B. This is only the language of a theory, and that theory not mine; nevertheless, I think it is consistent with itself.

Glenlair, Aug. 13 J. C. M.

Reflected Rainbows

I READ with great interest, in Prof. Tyndall's American lectures, a statement about the rainbow which appeared to me so extraordinary, that I determined to test it on the first opportunity.

The statement (I have not the book with me here, and give merely my recollection of the substance) is that, owing to the want of the necessary condition of parallelism the rays scattered from rain-drops cannot be so reflected as to show a rainbow by reflection from the surface of a lake.

Of course we all know that the same rainbow cannot be seen from two places at the same time, and therefore no one would

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* Die Atome und ihre Bewegungen, von Gustav Hansemann. E. H Mayer: Coln, 1871.)

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expect to see the *same* rainbow directly and by reflection. It is also reasonable to suppose that, as a rainbow is often seen from one place and not from another, a rainbow may often be seen directly and not reflected, or *vice versâ*. The reference to the necessary condition of parallelism shows that it is something more than these obvious deductions from the laws of reflection to which Prof. Tyndall wishes to draw attention in the passage mentioned. Until I tried the experiment described below, I imagined him to mean that there was something about the direction or arrangement of the rays of light producing a rainbow, which prevented their forming a rainbow or anything like one, after reflection from the surface of still water. It is not always easy to arrange so as to have a rainbow and a still lake to experiment upon. I managed, however, to get satisfactory substitutes in the spray bow at the falls of the Rhine near this, and a small pool of water. I was greatly disappointed on looking into my pool, to see reflected not only the scenery of the falls, but also a very fine spray bow.

What then can Prof. Tyndall mean? How is this peculiarity of rainbows to be observed? I have tried it in the only way of which I could think, but am now inclined to believe that I must have mistaken Prof. Tyndall's meaning.

Schaffhausen, Aug. 23 Z. X. Y.

The Origin of Nerve Force

One at least of the "obvious difficulties" which your correspondent, Mr. Henry R. Proctor, finds in my hypothesis as to the origin of Nerve Force, would scarcely have existed if he had directed his attention to a sentence in my article (Nature, July 31), which runs thus: "In what are termed hot-blooded animals, that is, in mammals and birds, the difference of temperature between the surface and the interior is considerable under all natural circumstances, and in them there is a regulating action of the skin by which they maintain a uniform internal temperature, *always hotter than the surface*, whatever that of the external medium may be." The correctness of this proposition as regards the human being is now a physiological fact, as many observers from different starting points have arrived at the same conclusion; among others, my proof of it has appeared in the "Journal of Anatomy and Physiology" (vol. vi. November 1871). When the temperature of the atmosphere is above 70° F. the amount of perspiration is always proportionate to the temperature, and is sufficient to maintain the depths of the body at 98° or so. Below 70° the same condition results from the influence of cold on the cutaneous vessels, they contracting in proportion to the degree of cold, and so modifying the radiating and conducting power of the body surface. There is never therefore any reversal of the current, or a temperature at which it is *nil*.

Your correspondent's third paragraph contains an assumption, as great and not so reasonable as my own. Why should we have to assume that the body has to be kept at a constant temperature of 98° or so? There is no *a priori* reason in its favour. It may be said that the chemical changes which occur, being dependent on the properties of albumen, fibrin, &c., could not be continued under other circumstances. That, however, is only a shifting of the ground of argument, for it is much more reasonable to suppose that the properties of the animal tissues are the result and not the cause of the conditions under which they have been brought into existence.

I may mention that the physiological phenomena attending the immersion of the body in air and water of different temperatures are of quite a different character; they are scarcely comparable, and can be shown not to depend to any extent on the different conducting powers of the media, or their different specific heats. Immersion of the nude body in air of 30° is not rapidly fatal, even if the temperature is not kept up by violent exercise; and I cannot understand "immersion in water at 30°."

If the comparative coldness of the brain were the effect of absorption of heat in the building up of its elaborate texture, we should expect to find a similar condition in the muscles, which are also of very complicate construction. Such, however, is not the case, and therefore another explanation has to be found, which my hypothesis supplies.

Aug. 26 A. H. Garrod

The Flight of Birds

I have just read with great interest, in Nature of Aug. 21, Capt. J. Herschel's account (elicited by Mr. Guthrie's letter, vol. viii. p. 86) of his ocular and telescopic observations of Indian kites at rest in mid-air, and I am tempted to offer an explanation which occurs to me of the way in which that aërial balance may be maintained.

If there was no quiver of the wings perceptible "at an apparent distance of ten or twelve feet,"—if the very tips of the wings "looked as steady as those of a stuffed specimen,"—then certainly the theory of self-support by muscular action must be abandoned, and the problem is reduced to one in which we have only to consider the weight and shape of the bird with outspread wings and the velocity and direction of the wind.

If the direction of the wind is slanting upwards with moderate velocity, it is conceivable that a bird, facing the wind, with outspread wings in a plane inclined between the horizontal and the direction of the wind, might remain at rest, from the following considerations:—

If the air were at rest, the bird, with the plane of its wings inclined a little downwards and forwards, would not fall vertically, but would slide obliquely forwards down the air, like a returning boomerang, or an inclined sheet of paper let fall, and would reach the earth at some point far from the vertical. But suppose, instead of the air being at rest, there were a slant upward current of air meeting and balancing the slant fall of the bird: then the bird would remain motionless in mid-air.

Capt. Herschel rejects (perhaps too hastily) the notion of "slants of wind," and asks "what becomes of the horizontal force" of the wind. Surely its effect would be to balance the horizontally resolved portion of the bird's slant fall, just as the vertically resolved portion of the slant current of wind would balance the vertically resolved portion of the slant fall.

Different degrees of inclination and force of the wind might be met (within limits) by different degrees of slope and spread of the wings.

I must confess this is only theory. We want more observations, as keen and careful as Capt. Herschel's, to ascertain the force and direction of the wind attending this arrest of motion in mid-air. Slant currents are common enough on a small scale among house-walls, and on a larger scale we may see how the wind pounces down on a land-locked water, or presses up a mountain side. In a steady wind, the shapes of hill and valley must cause certain regular currents variously inclined to the horizontal, and some of these, I suppose, the eagles find and use. On the lee side of a hill (as in the case given by Captain Herschel) there would be a current rising from the eddy to join the main course of the wind. The conditions described by Mr. Guthrie were just such as would throw the wind into upward slanting currents.

We should want a well-balanced weather-cock with a double vane (one plate in a *horizontal*, the other in a vertical plane), to tell the *vertical* as well as the horizontal deviation of the wind.

Dacre Park, Lee, S.E., Aug. 24 Hubert Airy

Mallet-Palmieri's "Vesuvius"

My absence in Spain during the months of March and April prevented my having seen Nature for the 20th March, and left me until a few days since in blissful ignorance that it contained a lengthy critique by Mr. Mallet on my review (Nature, Feb 6) of his translation of "Palmieri's "Incendio Vesuviano." This accounts for my silence, as, had it not been the case, a reply from me would certainly have appeared at the time.

For, being "the reviewer reviewed," I suppose I am indebted to my habit of not taking advantage of a reviewer's privilege, but of signing my name in full, since I do not find that Mr. Mallet vouchsafed a reply to any other review of his book, not even to that contained in the *Geological Magazine* for March, which, as the organ of British Geological opinion, might be expected to have the preference over mine, even if its reviewer had not incurred special claims on Mr. Mallet's attention, by having handled his production in a vastly less tender manner than I had done.

In comparing the two translations of Palmieri's little pamphlet, I give preference to that in German by the eminent mineral chemist Rammelsberg, if for no other reasons, for its cheapness, and because the translator puts forth the work of the Italian professor entirely on its own merits as one which did not require to be heralded by any elaborate preface to make it take with the public, and also because it seems somewhat unfair to see the worthy Professor's excellent observations made a vehicle for introducing the public to what, although entitled "an introduc-

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